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Codes and Standards

From the Editor . . .

We live in a world saturated with marketing messages. It is impossible not be bombarded by messages promoting products or services. Marketing messages have become invisible to us because they are so widespread. Savvy marketers know that the best form of advertising is to have the message delivered as editorial content. In the movies and TV it is referred to as product placement.

What builder or developer has not tried to gain attention for their work by sending out a press release touting something catchy about the project, with the hope that an editor will pick it up and run the story as an editorial?

If you analyse media coverage, you will note that much that passes for news is actually someone's promotional blurb, cleverly packaged and presented as news. The bigger the corporate entity behind the message, the more cleverly it is packaged and masterfully kept at a distance from the blatant commercial message.

I don't mean for this to be an anti-corporate or anti-marketing rant. Rather, my point is that we need to be more aware of this strategy because it has a direct bearing on us. Collectively, these marketing messages help create lifestyle images and expectations that often are unrealistic. They create an acceptance for products, desire for ways of doing things, and even fads that can be detrimental to the common good, if not downright technically wrong.

Let there be no mistake, marketing does influence the social agenda and creates a demand and expectations where none existed. It is the glossy photo magazines and TV shows that have been important in creating images of what desirable lifestyles should be. It has also influenced the way our houses are designed today and the features we put into them. Let's not forget that a lot of things we build into our homes, or make use of today, did not even exist a generation ago. We could comfortably live without them too, but for the fact we've been convinced of their need.

An advertisement is recognized for what it is - a simple, perhaps clever, "buy this" message from the person peddling a product or service. When it is hidden in a more subtle presentation, distortions can set in and become outright lies. We constantly see promoters taking a grain of truth about their product and transforming the message. In some cases, the message is altered so much, that on close examination it is contrary to good sense or sound building science. They get away with it because the language used is carefully couched in terms that a lawyer has reviewed, and full of fine print that few even notice.

Unfortunately, the false expectations and images created can also lead to mixed messages about what is good building practice. We have seen building designs built incorrectly for the climate in which the building is put, leading to a lot of problems. Lately, we have seen products marketed with impossibly outlandish claims about their insulating performance.

These kind of dubious practices are one reason why so many people are sceptical of promises made by our industry, and why so many people have a false impression about what kind of housing they can afford to buy. These are issues of concern not only for an individual product or project, but for the whole industry.

Richard Kadulski,
Editor

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Codes and Standards

Codes and standards are created to define minimum performance levels, be it for products, systems or services. Increasingly, we rely on standards in all endeavours. They become the yardsticks by which everything is measured.

However, what is in the standards document is not always understood - especially by users who rely on its standards but are not party to the drafting of the document. In most cases, only a few people directly involved with a narrow range of activities will be familiar with what is in a particular standard. The challenge for anyone that must rely on standards is to understand what is the relevant aspect covered by the standard.

Because standards must be appropriate, they are generally developed by committees that include a wide representation of members. To ensure all possible points of view are covered and a fair and level playing field is established, a performance level in a standard may not be as high as it could be. Because of the number of people involved, the process can be slow, cumbersome and expensive to develop, update or change.

There are three types of standards:

- ☞product standards, which generally deal with loads and performance expectations.
- ☞manufacturing standards, which primarily deal with components and materials.
- ☞installation standards, which mainly deal with details and materials.

Some standards cover all these aspects, others only a single issue.

Consider the standard that applies to sheathing papers, and which has been referenced by the building code for years. Code users are interested in the performance of the completed building. They are concerned with the properties of sheathing papers, such as their durability, water resistance, and vapour permeance. However, for years the standard only dealt with the product's manufacture and not with its performance or durability.

Standards for Windows

A study presently nearing completion, being done as a part of the research activities undertaken as a consequence of the building envelope failures in Coastal B.C., has looked at window standards. It looked at how existing codes, standards, testing and certification processes deal with the water penetration resistance of windows. The main standards that deal with water penetration control and that apply to windows are the National Building Code, CSA (A440.0, .1 and .4), and the North American Fenestration Standard (NAFS).

The results of more than 200 tests were analyzed to see how windows performed, and if testing is a useful tool for predicting in-service performance. The studies found that the main causes of building envelope water leakage involved windows. This study also examined lab and field test results to see how they deal with water penetration resistance.

Virtually every study of building envelope performance problems points to windows and the window to wall interface as a primary contributor, so it is was felt important to find out if the problems are an inherent part of the way windows are tested and designed, or the way they are used.

Six water leakage paths were identified - through a fixed glazing unit, around an operable unit, through the window to wall interface, through the window assembly into the wall, through the connection between the window and the adjacent wall, and through the window into the window itself.

Laboratory tests showed there is one dominant leakage path: around the operable unit to the interior. Field tests, on the other hand, showed that

Access to Standards

Worldwide, standards organizations have shifted to cost recovery. As a consequence, the cost of standards is high, and they are not easily accessed by designers, builders or building officials, making it difficult to determine whether or not a product meets a standard.

Even corporations, agencies and building officials that one would expect to have a copy of the standards seldom have the most relevant standards in their library.

Why do we need to look at water penetration of windows?

"Most windows seem to function satisfactorily when they are protected by eaves or other overhangs, or are in sheltered locations. It is desirable to maintain good principles of water control around windows to achieve long service life . . . When problems do occur they are usually serious and result from ignoring the simple facts about water penetration."

from *Rain Leakage of Residential Windows in the Lower Mainland of British Columbia,* 1984, NRC Building Practice Note, by Blackall & Baker

all six leakage paths are significant.

When the results were compared to the tests done for compliance with CSA A440, it was noted that the CSA tests can't be considered to apply to potential leakage at the window to wall junctions. In other words, a compliant window could still cause water leakage because installation practices are not covered by the standard, and water leakage paths not tested as part of A440.

Increasingly, windows are tested when installed, since it is desired to achieve a durable installation. While it is possible to test installed windows for their initial water penetration performance, these tests will not ensure that the windows will meet performance criteria. When first installed, face seal or rainscreen designs can pass the test, but unless there is some added redundancy in the system, there is no certainty the face sealed units will give an equivalent performance to the rainscreen designs over time.

Because materials age and it is not possible to achieve perfection in the manufacturing or construction process, it is not easy to test installed windows for durability. Ultimately, durability will be achieved by a design which inevitably involves redundancy.

It is possible to state that face sealed designs have no redundancy built in, so they are not durable. On the other hand, window installations with sub-sill drainage have redundancy and will be more durable. The amount of redundancy needed would depend on the level of risk - the exposure condition of the window, which is a factor of the building design, its location and microclimate conditions.

Standard design assumptions and testing usually do not consider microclimate exposure conditions. The CSA water leakage (B) ratings reflect a peak exposure event. However, microclimate exposure may reflect frequent periods of wetness, and will determine how often and for how long a window and window-to-wall junction remains wet. The length of time the assembly remains wet will also depend on the building form, overhangs, and local terrain. Time of wetness affects the leakage paths that happen regardless of pressure differential (gravity is primary driving force). It becomes more significant as materials age.

Water leakage is best managed through a control strategy that includes redundancy in the designs to suit microclimate conditions. This requires careful consideration of window rainscreen vs. face-seal designs, as well as careful installation of sub-sill drainage.

Water penetration around operable units is the dominant leakage path in windows. This happens because there appears to be a lack of understanding of conceptual design issues. The air tightness of gaskets and drainage are not designed properly, and the sill extrusion height is not adequate to deal with the moisture. There is inadequate quality control both in the manufacturing shop and on the job site.

The window-to-wall connection is the main leakage path for the installed window. Durability can only be ensured by proper design and field testing of the assembly. Often, the appropriate rating is not specified. Frequently, water leakage happens at pressures that are lower than recommended, and because code requirements are lower than those recommended by the CSA A440 User Guide.

The National Building Code (NBC) sets out minimum standards. Users often expect it to define optimum or ideal criteria.

Part 5 of the NBC does not acknowledge the importance of microclimate exposure conditions which can include overhangs, local topography and weather patterns. Nor does it offer any guidance on appropriate water penetration control strategies for assemblies and components with differing exposure conditions. It is silent about appropriate design of interfaces such as sub-sill drainage.

Part 9 does not acknowledge that exposure conditions for many Part 9 buildings can be as great as for many larger buildings. No consideration is given to microclimate exposure conditions, nor is there any recognition of differing water penetration control strategies for differing exposure conditions.

Study of Manufacturing, Building Design, Installation and Maintenance Factors and Study of Codes, Standards, Testing & Certification, studies being completed by Dave Ricketts, RDH Building Engineering Limited for CMHC, BC Housing and Homeowner Protection Office

CSA A440 Standard A440.0 (Windows) and A440.1 (User's Guide) is a Manufacturing Standard. It does not consider performance of interface of the window-with-wall, nor does it deal with combination windows. (For example, a picture window with a transom unit over or a casement with a picture).

CSA A440.4 is a window installation standard but is poorly organized. For example, rain penetration control is considered as a subsection of air tightness. There is little treatment of water penetration control, and there are some inappropriate or overly prescriptive requirements.

The CSA standard contains no requirements to retest or do periodic sampling. It does not address window installations, and there is a lack of information with respect to product description

Certification Limitations

CCMC has no requirements for retesting or periodic sampling, and does not address installation.

The SAWDAC Window Wise program is not in use. It applies only to retrofits, and does not parallel A440 ratings. Only one type of installation procedure (foam at the perimeter) is considered. ☼

Ice Damming: What My Own Roof Taught Me

by Joe Sartor

When we moved into our Toronto house in 1985, it was 18 years old. We were thrilled to have found a house that looked so well built - fine stone and brick masonry, copper eaves troughs, high-quality windows and doors, fine quality millwork, a fully-finished basement, a hot water heating system with thermostats in each room, and best of all, no apparent basement or roof leaks or other moisture problems.

I was even more pleased to discover, while doing renovations, that the solid-brick walls of this 1960s bungalow were stopped with 2x2's - not the usual 1x2s, and the cavity filled batt insulation - even in the basement!

In the attic there was no sign of condensation, leaks, mould or moisture of any kind on the rafters or 1x8 roof sheathing boards. This seemed odd, because there was virtually no attic ventilation. Glass fibre batts blocked most of the rafter spaces at the eaves, and there was only one vent opening in the roof (an automatic attic exhaust fan which expelled excess heat in summer) to ventilate the attic during cold weather. (However, the attic got very hot in the summer even with the exhaust fan going full blast!)

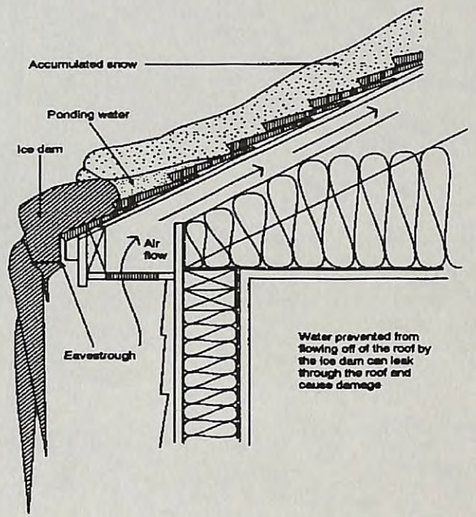
The lack of condensation moisture damage to the roof sheathing was probably due to the fact that the house was virtually unoccupied for most of its 18 years. So there was little moisture produced in the house to leak into the attic to cause condensation.

The attic itself is unusual. There was a large, unobstructed, insulated ceiling-access hatch in a walk-in closet, and a layer of 3/16" (4mm) plywood nailed over all the 2x6 ceiling joists and insulation, to within three feet of the exterior walls. An investigator like me could crawl around with ease under the collar ties, without a face mask and with no fear of stepping through the ceiling.

In winter, we didn't get roof ice dams or icicles hanging from the eaves either, while most of our neighbours did. This seemed to be because roof heating cables had been installed in the two valleys, the eaves troughs, and down-spouts, and was likely why there were no attic water stains or roof ice-dam leaks.

We lived with his happy condition for many years, except when we neglected to turn on the power to the heating cables. Then we were surprised to see how fast the ice could build up in the troughs and valleys, and how slowly and incompletely it melted around the cables when the power was finally on.

Then late in winter a few years ago, one of the two old heating cables stopped working so we got major ice damming at one of the valleys, and ice build-up in the troughs on that side. It was no consolation that a great many other houses in this



From CMHC Renovator's Technical Guide

part of the country experienced serious ice damming that winter.

As a typical homeowner, I procrastinated and did not fix the problem right away.

The following year, the other cable stopped working and I was being asked embarrassing questions about the huge icicles in front of the kitchen window, and the ice dams causing leaks and peeling paint on the fascia and soffit at both valleys. Fortunately, there were no interior leaks.

My investigative experience convinced me that all or most of our ice damming was due to warm air leakage into the attic, especially from the perimeter walls, so I decided that air-sealing and insulating the tops of these walls with Sprayed Urethane Foam would solve the problem in our house, as it had for the other houses I had investigated.

The air sealing is not an easy thing to do properly from the inside because of the difficulty of working in the tapered attic space near the outside walls, even with a plywood floor over the joists as in my attic, but easy to do from the outside if the roof and sheathing can be removed for access.

Since we were due for a new roof, we decided to redo the roof and, at the same time, to air-seal the top of the perimeter walls.

Our plan was that, after the shingles, and sheathing over the top of the outside walls was removed for access, sprayed urethane foam would be applied over the wall space to do the air-sealing and insulation required.

When the roof sheathing boards were temporarily removed, we were surprised to find that all the rafter spaces were neatly blocked at the outside wall face with boards, so that very little air was getting into the attic from the existing eight screened soffit vents. No wonder that the ice damming was so severe when the heating cables weren't working!

At the same time, I wondered why there was no moisture staining or mould on the rafters and roof sheathing if there was virtually no attic ventilation. If the ice dams were caused by the heat and warm, moist air leaking through the ceiling from the house and warming the roof, then the moisture in the leaking air should have been condensing on the cold underside of the roof sheathing. Was there some other cause of the severe ice damming and icicles?

I got an unpleasant feeling that I had to rethink and revise my strongly-held views about what causes ice damming.

While my soul-searching was going on, the 1x6 boards blocking the rafter spaces were removed, the sprayed urethane foam applied over the outside wall strapping space, (leaving a ventilation space under the roof) the sheathing boards replaced, and the new shingle roof installed, complete with underlay and drip-edge flashing.

In grappling with the problem of finding a second possible major cause of my roof ice damming, I thought back to my investigations of ice dam leakage over the past few years. I realized that in almost every case, some or all of the leaking was at valleys.

Then it hit me - the valleys themselves are vulnerable because so much snow accumulates there in winter. Because of drifting into these low spots, a thick layer of snow quickly fills the valleys, insulating the valley area from the very cold outside temperatures. On the inside, the valley shape is an upside-down ridge or hip, and is more exposed than the rest of the roof to whatever radiated and conducted heat comes from the ceiling below. The underside of the valley is never directly cooled by venting air from the soffit which passes though the rafter spaces because the valley is angled away from the eaves on both sides.

These factors can raise the temperature of the valley roof surface under the snow to above the freezing point, causing the contact layer of snow to melt. This melt water then runs down the valley to the outside wall and the cold soffit, where it freezes and forms the classic ice dam.

On my roof, without functioning heating cables in the valley above the cold eaves, most of the melt water could not reach the trough because of the ice dam, so the water backed up, seeped through the shingles and caused leaks. Without functioning heating cables in the eaves trough and downpipe, any melt water in the troughs could not drain away, so it froze, built up, and overflowed, forming icicles.

It became clear to me that there is a second major cause of roof ice damming: deep snow layers in valleys which insulate the roof from the cold outside air and allow the heat from the attic to warm it up enough to melt the contact layer of snow and start the damming process.

In our case, we were actually getting very little heat loss and warm air leakage, so there was little excess attic heat or moisture to create condensation and mould, but there was enough heat from the ceiling to warm the roof because of the lack of ventilation air to cool it. So without heating cables to melt the snow over the eaves, we still got ice dams in the valleys.

These thoughts reminded me of yet another peculiar condition I encountered in several investigations of roof dam leaking that I had done.

Whenever there was a junction of the sloping roof with a vertical wall, such as the side of a dormer or the upper storey wall of a split-level, there was always a localized ice dam at the eaves directly below the wall, even though the shingles were usually bare against the wall.

It became obvious to me that heat loss from the wall as well as from the attic below was raising the temperature of the roof against the wall, melting the contact layer of snow and all the snow near the wall triggering the damming process.

So now I had a third major cause of roof damming, vertical walls intersecting a sloping roof, heating the roof beside, and starting the melting of the nearby snow and build-up of the ice at the eaves to form a dam.

In addition, sunshine and the daily temperature fluctuations are an integral part of all or most roof ice damming situations. When the sun strikes the wall and heats it, both radiation and conduction of heat to the snow near the wall tends to melt it, then the melt water runs down the sloping roof to the eaves to freeze, especially at night when the temperature drops.

Even where there is no wall to reflect heat, any thin snow or bare spots on the roof will heat up when exposed to the sun, especially on a dark roof melting the snow. The melt water at the eaves quickly freezes at night and forms ice dams at the eaves, and builds up in the troughs to form icicles.

So it seems that even sunshine can cause ice dams! One more cause gets added to the list. Sunshine also tends to melt the surface layer of snow when temperatures are not too low. This ice water drains into the troughs and will freeze, build up, and form icicles unless heating cables are installed the troughs.

I now realize that one of my colleagues was right when he pointed out at the Toronto Ice Dam Symposium in March of 2001 that warm air leakage into the attic from the ceiling below wasn't the only thing that causes ice dams. My experience until then had convinced me that when we stopped the warm air leakage, we stopped the ice dam damage in the rooms below, and I wanted to get that message across.

I had forgotten that I also recommended to my clients that they should install self-adhesive membrane under the shingles at eaves and valleys if they were replacing the shingles, in order to stop ice dam leakage that would continue for reasons other than excess heat from below. I also recommended roof heating cables (with automatic controls) at some roof edges in the troughs, and in downpipes, to prevent ice build-up and hazardous icicles.

It didn't occur to me that these recommendations were all remedies for ice build-up that was not necessarily the result of excess warm air leakage from the ceiling into the attic space. I was offering solutions to ice damming problems that were caused by conditions other than excess ceiling heat loss into the attic and I didn't realize it!

So that was the lesson that my roof taught me - that there are many causes for the formation of roof ice dams, not just the one (even though it's the main one) that I had thought. It also reminded me to listen more carefully the next time my cherished beliefs are challenged by knowledgeable people. ☼

Joe Sartor (Mr. Leakproof) principal of Contec Building Science, is a building envelope consultant specializing in leak investigation and difficult moisture problems.

He spoke at a roof dam symposium in Toronto in March 2001, showing how warm air leakage from the ceiling causes ice dams on sloping shingle roofs. His talk implied that correcting ceiling air leakage would eliminate ice damming, but this was challenged by other speakers.

Joe 's experience since then has shown that there are several other causes of ice damming, and this article describes a peculiar case study that led to his enlightenment on the subject.

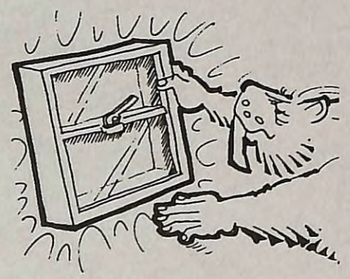
BC Building Envelope Class Action Lawsuit Turned Down

The building envelope failures on the west coast of BC has spurred considerable research and education. Because of the extent of damages, and the number of projects affected, there has been much to keep lawyers busy. Most cases to date have been settled out of court.

A proposed class action lawsuit was launched against the provincial government. Although the case was in the name of an aggrieved homeowner, the lawsuit was funded mainly by the development community. The claim in the case was that the building code was to blame for the leaky buildings.

The judgment in the proposed class action against the province was released at the end of November. The judge concluded that the proponents failed to demonstrate that they have a cause of action so the application to certify the case as a class proceeding was rejected. In effect, the judge agreed with the defendants that the building code was not the cause of the envelope failures. ☼

What Should You Look for When Shopping for Windows?



We use windows to bring light and views into the home. Since they are supposed to be transparent, most attention is given to the visible parts of the window - the window frames and operating hardware.

A nationwide US survey of consumers found that the condensation resistance of windows is more important than the U-factor (thermal transmission) or solar heat gain ratings. Eighty-five percent believe it is important that new windows "reduce interior condensation" in their homes.

In cold climates, condensation formation on the inside of window surfaces is a big concern. If it happens only occasionally, condensation on glass surfaces may simply be an aesthetic concern, reducing visibility or view through the window. But if it happens regularly, the excess moisture can have a negative impact on curtains, wall, carpets and what is more important, on the window and structure itself.

To increase the resistance of windows to condensation, it is important to maintain the surface temperature of the window above the dew point. To accomplish this, windows must have a low thermal transmittance (U-factor) for the total window not just reduced conductivity of various window components. This means looking at glass specifications. The type of low-e coating, type of gas fill, and whether or not the spacer is insulated.

In the US, the National Fenestration Rating Council (NFRC), the window rating body, is developing a condensation resistance rating. Condensation resistance, as the rating will be called, will be a number on a scale of 1 to 100, with a higher number being more resistant to condensation than the lower number. The rating will be determined by computer simulation using standardized temperature conditions of 0 °F (-17 °C) outside and 70 °F (21 °C) inside at three relative humidity levels (30%, 50% and 70%). Condensation resistance of the window will be determined by the lowest rating obtained from the three component areas.

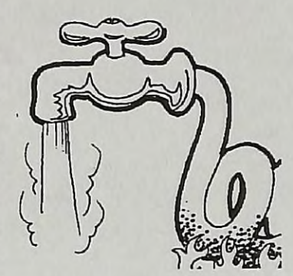
The assumption is condensation on interior surfaces only. There are some times of the year when condensation could form on the exterior of the window, especially higher performance windows. ☼

U-Value

The rate of heat loss is indicated in terms of its U-value. The lower the U-value of a window or other construction assembly, the greater its resistance to heat flow and the better its insulating value. U-values for windows generally fall between 0.20 and 1.20.

The insulating value is indicated by the R-value which is the inverse of the U-value. A window with an overall R-value of 2.8 has a U value of 0.35. An R-19 wall has a U-value of 0.05.

Safety of Hot Tap Water



Few people realize that hot water burns like fire. More than 300 people are hospitalized each year in Canada for scald injuries caused by hot tap water. Children, the elderly and people with disabilities are especially at risk because they have a slower reaction time, have thinner skin or a combination of these factors. These types of burns are extremely painful and have a significant economic impact on families and society in general. The real tragedy is these injuries are predictable and preventable.

The hot water temperature in a typical Canadian home is 60 °C (140°F). At this temperature, there is virtually no opportunity to escape severe scald burn injury. At 60 °C, human skin burns in 1 to 5 seconds, while a child's skin will burn in less the one second. A small reduction in temperature would have a significant impact on reducing the number and severity of injuries.

Tap water scald injury is a drain on the health care system costing well in excess of $ 150 million in direct health care costs over the past twenty years, with hospital stays averaging 21 to 35 days. A child victim of a tap water burn injury is 28% more likely to be admitted to a hospital compared to 4 to 5% for all other types of injuries.

The elderly population is at a much greater risk of death due to complications from these injuries. People with diabetes, congenital abnormalities and other ailments that cause skin insensitivity are also more vulnerable to becoming hot tap water burn victims and their rehabilitation can be prolonged by complications.

The National Building Code of Canada allows for hot water storage tank temperatures to be between 45 °C (110 °F) and 60 °C (140 °F). In Canada, hot water tanks are typically set at 60 °C, and there are virtually no requirements to temper the water to safer temperatures. Recent changes to the National Plumbing Code require tub/shower combinations to have a tempering device to limit the shower outlet temperature to 49 °C (120 °F).

New Zealand and Australia have mandated through building codes the use of temperature control devices to limit temperatures. Some states in the USA passed legislation more than twenty years ago to require that hot water tanks be installed and pre-set at 49 °C (120 °F). A Washington state review of the effectiveness of the lower temperatures, 5 years pre and 5 years post the legislation found that hospital admissions for tap water injuries were reduced by half. Since 1988, the hot water heater industry voluntarily agreed to pre-set their hot water tanks nation-wide at 49 °C. However, American products shipped into Canada are still set at 60 °C to match the Canadian practice.

The applicable Canadian Standards Association (CSA) standards for product performance of domestic electric and oil-fired hot water tanks are silent on a hot water temperature setting with the exception of gas standards.

Many concerns have been raised about the safety of hot water at a lower temperature, especially the risk of legionnela, the bacteria that causes Legionnaire's Disease. Health Canada recently assessed scientific evidence in regards to lowering temperatures to 49 °C in domestic hot water systems against the risks of contracting Legionnaires's Disease. The review found there is no justification for the concerns. They supported the reduction of hot water tank temperatures to 49 °C, to lower the known risks of scald burn injury. The Canadian Hospital Infection Control Association also recommends reducing the temperatures in hot water tanks to reduce scalding incidents in the home.

Safe Kids Canada, a national injury prevention program of The Hospital for Sick Children, launched an advocacy campaign seeking regulatory changes to lower domestic hot water temperatures to 49 °C. ☼

Information
www.safekidscanda.ca
tel: 1-888-723-3847
fax: 416-813-4986

Procurement List for the R-2000 Standard

The R-2000 Standard includes a requirement to use specific building materials in R-2000 construction. The criteria for these materials are outlined in the R-2000 Standard pick-list and a minimum number of products from the list are to be used. To provide maximum flexibility, the pick lists are general, so that many different products can meet the intent of the standard.

The generic nature of the pick list descriptions also make it more challenging for builders to know which specific products comply. One of challenges is the constantly changing environment. Manufacturers come and go, product lines are constantly being modified. CHBA is working to develop a procurement list as an aid for builders. We are presenting information here from the work in progress.

The Internet provides a useful resource, as many companies now publish their product literature on the web. It is probably the best starting point to identify possible product sources. However, there is no regulation over the web, and it can be very frustrating to navigate. In addition, the information may not be adequate or there could be not enough relevant information making it difficult to do a proper product assessment. Another challenge may be that given products may not be available in all areas.

A Canadian web site that provides information on green building products and practices is the Green Building Materials Virtual Sample Room (*www.designinggreen.com*). Another useful information source is the Green Building web site. This is a US-based database, but most products should also be available in Canada. (*www.greenbuilder.com*)

Other useful resources for materials with low emissions are CMHC's book ***Building Materials for the Environmentally Hypersensitive***, and ***The Healthy House*** book by John Bower.

Indoor Air Quality Features

Carpeting

The R-2000 Standard requires carpet to have a *Canadian Carpet Institute Green Label when it covers more than fifty percent of the floor area of the house.* The intent is to use materials that will contribute few emissions into the indoor air. The Green Label program was developed in the United States by the Carpet and Rug Institute (CRI) and has been adopted by the Canadian Carpet Institute.

Acceptable floor coverings that are exempt include wool or cotton area rugs, and carpeting that has latex-free backing. These exempt floor coverings must not be glued down and cannot have underpads.

Manufacturers of Green Labelled products are listed on the Canadian Carpet Institute's web site (*www.canadiancarpet.org*) in the members section.

It is important to note that one could install a low emissions carpet with a very unhealthy underpad thus completely undermining the objective of the Green Label carpet in the first place. That is why the selection of a carpet underpad must also be considered carefully. The Canadian Carpet Institute's Green Label program currently covers underpads and lists several manufacturers.

For information on the R-2000 Program, contact your local program office, or call 1-800-387-2000 www.R-2000.ca

Paints and Varnishes

All paints and varnishes used indoors, including finishes on wood floors, must be water-based, interior type or meet or exceed Environment Canada's Environmental Choice Standards. Pre-finished items are allowed.

Most paint manufacturers have products that would comply. Listings of appropriate paints and varnishes can be found on Environment Canada's Environmental Choice web site (*www.environmentalchoice.com*).

Floor Adhesives

All finish floor adhesives must be water dispersion, low-toxicity formulations or pre-adhesive types.

"Low-toxicity" is not defined. However, Environment Canada's Environmental Choice program covers flooring adhesives. Products with an Environmental Choice designation are considered to be a "low-toxicity formulations" and should help improve the overall indoor air quality.

Building Materials for the Environmentally Hypersensitive lists a dozen adhesive products considered appropriate for use in homes for the environmentally hypersensitive. These range from white glues for wood products to mortars for ceramic tiles.

Kitchen Cabinets and Bathroom Vanities

Cabinets and vanities shall be solid wood or, if made from manufactured wood products, shall be made from formaldehyde-free fibre board; or particleboard meeting the E-1 European standard or the HUD Standard, 24 CFR Part 3280.308; or have all exposed surfaces sealed with an Environmental Choice-approved sealer or a low-toxicity sealer.

This is a requirement that has caused concern. It is not feasible to list all cabinet makers of acceptable cabinets since many are local workshops. All types of solid wood cabinets are permitted by the R-2000 standard. Acceptable products also include cabinets made from manufactured wood products that are formaldehyde-free fibre boards or particleboard meeting one of the standards.

For particle board to meet the required formaldehyde emissions, it must not exceed 0.1 parts per million (the German E-1 standard). For lower formaldehyde levels, the US EPA suggests using wood products such as particleboard, MDF, or hardwood plywood that are labelled or stamped to be in conformance with American National Standards Institute (ANSI) criteria. Particleboard, should be in conformance with ANSI A208.1-1993. For particleboard flooring, ANSI grades "PBU", "D2", or "D3" are actually stamped on the panel. MDF should be in conformance with ANSI A208.2-1994; and hardwood plywood with ANSI/HPVA HP-1-1994. These standards all specify lower formaldehyde emission levels.

Unfortunately, information about a product is not always clear as to which standards it meets. However, suppliers will be able to provide information on the material they use. Cabinets made from products such as Medex, or Medite are formaldehyde free. Similarly, cabinets that are finished with melamine are acceptable, but all surfaces must be sealed, including where cutouts are made and the back side. Another area often overlooked is the underside of prefinished laminate countertops which are usually a laminate on a regular particleboard base.

Vinyl Flooring

All vinyl flooring shall be either linoleum or synthetic vinyl tile. Sheet vinyl flooring shall not be used.

It is the soft, vinyl cushion flooring that is the concern for VOC emissions. Linoleum is made from natural raw materials and uses no synthetics. Worldwide there are only three manufacturers of true linoleum. All are based in Europe but their products are marketed worldwide, including Canada.

Forbo Industries, Netherlands (*www.forboresilients.com*)
DLW Linoleum Germany (now owned by Armstrong Industries, USA: *www.armstrong.com*)
Linosom Linoleum, France (available through *www.domco.com* in Quebec).

Synthetic vinyl tile is not defined. The intent was to accept vinyl composition tile (VCT) as an approved product. VCT is similar in appearance to the old vinyl asbestos tile (VAT).

Particle Board Underlayment and MDF

All particleboard-flooring underlayment shall meet the E-1 European standard on the ANSI A208.1-1993 Table B standard; or have all surfaces sealed with an Environmental Choice-approved sealer or a low-toxicity sealer; or be pre-finished.

The ANSI Standard 208.1 (1993) Particleboard sets the maximum formaldehyde emission at 0.20 ppm for particleboard decking and underlayment.

Some manufacturers of these products are:
Sierra Pine (*www.sierrapine.com*)
Temple, makers of TEMSTOCK (*www.tmple.com*)
Uniboard, makers of various low formaldehyde particlebard products (*www.uniboard.com*).

Truss Joist Macmillan (*www.tjm.com*) manufactures engineered wood products, including oriented strand board products using either resorcinol, phenol formaldehyde or polymeric MDI adhesives. The manufacturer's literature reports that all their products meet the German E-1 Standard of 0.10 ppm for formaldehyde emissions. ☼

Technical Research Committee News

Canadian Home Builders' Association

Moisture Management Technician Certification Program

The Alberta New Home Warranty Program has developed a comprehensive training program on moisture management issues in houses. The program consists of eight home study modules which take about 10 hours per module to complete. They are delivered by SAIT (the Southern Alberta Institute of Technology) by distance education on the Internet. On completion of the modules, a two day field practicum is done. Graduation from the course results in the designation of ***Moisture Management Technician***.

Companies who have a certified moisture technician on staff will be able to promote themselves as a ***Moisture Wise Builder*** and advertise their houses as ***Moisture Smart*** homes. Both brands have been copyrighted by the Alberta New Home Warranty Program and will be administered through a licensing agreement with the builder.

By the end of 2003 all builder members of the Alberta New Home Warranty Program will be required to have at least one person on staff in a senior construction decision-making capacity who has graduated from the course. Currently 40 persons are enrolled in the program, and a marketing campaign to further promote it is being planned.

Incompatible Building Materials

There is no central place for builders, renovators, inspectors and architects to register problems they experience with incompatible building materials. This means there is no shared learning about potential problems such as the premature degradation of polystyrene rigid insulation by solvent-based sealants and adhesives.

To help you avoid problems and having to learn by experience, the Canada Mortgage and Housing Corporation has initiated a research project to investigate and record problems attributed to building material incompatibilities. This includes a survey of the industry.

You can help by adding your knowledge and experience. They are looking for examples people have encountered.

Examples of known and suspected incompatibilities

Framing materials

- *Fasteners affected by cedar, redwood and treated wood products in wet locations*

Wet materials:
(sealants, adhesives and coatings)

- *Solvent-based sealants, adhesives and damp-proofing affecting polystyrene rigid insulation*
- *Silicone sealant affecting paintability and recaulking*

General

- *Metals affecting metals - dissimilar metals*
- *Copper tubing affected by aggressive (acidic) soils*

This is your opportunity to supply any examples of material incompatibility you have encountered.

Please explain the nature of the problem:
(symptoms, causes, conditions, time-frame etc.):

_____

_____

Solution:
(if there is one):

_____

_____

_____

Send any comments you may have to

Chad Ranger, CHBA
fax: (613) 232-8214
or
John Burrows
fax (613) 820-5862

The Technical Research Committee (TRC) is the industry's forum for the exchange of information on research and development in the housing sector.
Canadian Home Builders' Association, Suite 500, 150 Laurier Ave. West, Ottawa, Ont. K1P 5J4
Tel: (613) 230-3060
Fax: (613) 232-8214
e-mail: chba@chba.ca
www.chba.ca

Drain Water Heat Recovery System for Houses

Reducing the energy consumption of a dwelling requires the reduction of energy demand. This can be done by reducing energy and using the most efficient appliances. Some household energy can be recovered. One heat recovery option that is gaining more attention today is heat from domestic hot water that is flushed down the drain. Heat recovery from drain water offers significant opportunities for reducing the energy loads associated with domestic hot water needs of a house.

A number of heat recovery products are now appearing on the market. The principles are similar to that of heat recovery ventilators for ventilation air. Incoming cold water is preheated before going into the water heater and plumbing fixtures thus reducing the energy needed to heat the water. The drain water heat recovery system takes advantage of the fact that about 80% to 90% of all hot water energy goes down the drain.

A typical drain water heat recovery system is a heat exchanger that captures heat from warm drain water (from showers, kitchen sinks and other hot water used in the house) and transfers it to incoming cold water going into the water heater. It is a completely passive device with no moving parts or heating elements to wear out. The self-cleaning design assures maintenance-free operation. It will fit into almost any house, replacing a section of drainpipe in the basement.

A typical drain water heat recovery system is up to 60" long. It is a 3" or 4" diameter copper drain water pipe that is connected to the main drain system. The fresh water supply is connected to a ½" copper coil that is wrapped around the drain pipe. The units come in various lengths from 30" to 60."

The drainpipe conforms to drain pipe standards (conforming to ASTM B306) and the fresh water pipe is type L copper tube (conforming to ASTM B88). The drain water heat recovery system is approved for use in Canada with potable water according to ULC file #MH26850.

How effective are drain water heat recovery systems?

Oak Ridge National Laboratories in the US studied these systems in a multi-family building. The data showed there is significant variability in the amount of hot water used by people. Total average daily hot water consumption ranged from a low of about 250 litres/day in December to about 750 litres/day in April.

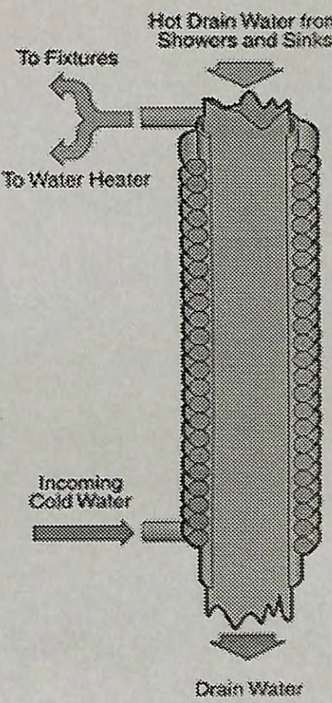
Regardless whether water consumption was high or low, the relative savings of the drain water heat recovery systems were much the same. It was found that the systems could save between 25 and 30% of the total energy needed for water heating. Over the year of one experiment, the system saved the equivalent of 2800 kWh of electricity.

The payback time for a specific application obviously depends on installed cost, the amount of hot water consumed daily and the cost for delivering hot water using the conventional water heater. Multifamily dwellings where two or more apartments share a common drain line or any applications with large water consumption will have short simple payback times.

The R-2000 program is developing a model for use with HOT-2000 to take into account the savings achievable by the drain water heat recovery system. The formula considers average local water mains temperature, fuel type (electric or fuel-fired water heater), and size of the drain water heat recovery system.

For a 60" drain water heat recovery system, the R-2000 annual energy credit is 1,760 kWh for electrically heated domestic hot water systems. For natural gas heated domestic hot water systems the energy credit is 10,133 MJ (or 10.1 GJ).

The R-2000 Standard assumptions for occupancy on which all calculations are done assumes a family of four occupants (two adults and two children) with a domestic hot water consumption of 225 litres/day supplied at about 131 °F (55 °C). It is assumed that about 70% of the hot water consumption is for showers, or about 157.5 litres/day. ☼



In Canada, the GFX system is distributed by RenewABILITY Inc., tel. 613-730-4568; toll free 877-606-5559, www.renewability.com

The GFX Drainwater Heat Recovery system, distributed by TR Strong Building Systems Inc, was voted the outstanding green product at NAHB's Fourth annual Green Building Conference in Seattle, in March 2002.

Energy Efficiency Is Making Gains in USA Housing

The Kyoto agreement has become synonymous with action on the climate change issue. The US government has decided not to sign the agreement and some groups in Canada are pressing the Canadian government to back off. What the debate misses is the underlying issue behind the Kyoto agreement which is the need to reduce the damaging impact of human activity on the earth's environment.

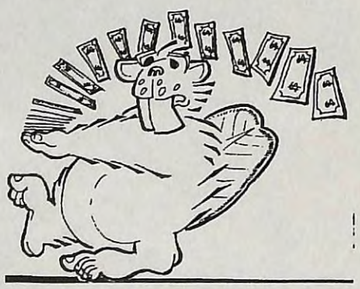
While the US government may not be endorsing action on Kyoto, there is still much activity taking place at the state and local level. In the housing sector, the Energy Star for Homes program is growing and expects to add 45,000 homes in 2002.

The Energy Star program is somewhat similar to Canada's R-2000 Standard. It is a voluntary certification program that promotes energy efficient construction. The labels provide consumers an easy way to recognize energy-efficient homes verified to meet the Energy Star performance guidelines. Each Energy Star home is third-party verified, and sets a standard of energy efficiency that is typically 30% more energy efficient than homes built to state building codes. In addition, energy efficient mortgage programs allow borrowers to afford a higher quality home without having higher incomes.

Key features of the Energy Star standard are familiar to R-2000 builders. They include a requirement for airtight construction, higher insulation levels, energy efficient windows, high efficiency and correctly sized heating and cooling equipment, and tightly sealed ducts for heating and cooling systems. ☼

US Energy Star Program
www.energystar.gov/homes

What's the Payback?



How often do you hear that question? It inevitably pops up the moment one mentions anything that could have an effect on energy efficiency. Decisions are often made on the basis of a simple payback calculation made on the back of an envelope. If an upgrade costs $1000 to yield a savings of $100, the simple payback is considered to be ten years.

There is another way to consider this: think of it as an investment.

At today's rates, a $1000 bond or GIC may yield about 3%, or $30 per year before taxes. Depending on tax bracket, this could net $18-20, for a rate of return on the investment of about 1.8-2%. On the other hand, a $1000 investment in energy efficiency that yields $100 in energy savings gives a tax-free return of 10%. Thus, that upgrade could be considered to provide a 10% rate of return. Since it is fair to assume that energy prices will only increase, and at a faster rate than in the past, that rate of return can only increase. Not bad when you consider that the rate of return on investments today.

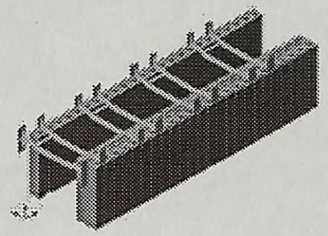
Hopefully, this way of looking at things may help convince your customers that more energy efficient construction is not just good for the environment, but also has a payback. ☼

Quad-Lock Insulating Concrete Forms New Product

Quad-Lock, a Surrey BC-based manufacturer of Insulating Concrete Forms (ICFs) has announced two new products.

Quad-Lock Plus is a thicker version of their standard Quad-Lock panel, which is 2 1/4" thick. The Quad-Lock Plus is a 4.25" (108mm) thick expanded polystyrene panel that provides a higher insulation value than any other North American ICF system. The panel was developed to comply with new more stringent energy codes in Europe. When used on one side of a wall with the regular panel on the other side, Quad-Lock Plus provides an R-value of R-32; if used on both sides the R-value is R-40.

The second new product is a 12" tie. The new tie complements Quad-Lock's existing line of ties which allow for construction of 4", 6", 8" and 10" concrete walls. One-foot thick walls are often used for retaining walls. The new 12" ties also work well with Quad-Lock Plus, creating a 10" thick concrete wall when constructing with Quad-Lock Plus.



For more information
Quad-Lock Building Systems
Tel.: (604) 590-3111 or 1-888-711-5625 (toll free)
Fax: (604) 590-8412
www.quadlock.com

High Thermal Mass Insulation Performance

R-32 is a realistic number for ICFs with 6 inches of EPS insulation. This compares with the R20 to R22 for most ICF systems on the market.

Some manufacturers have been touting R-values as high as R-56 for their ICF systems, most of which only have a total of 4 inches of foam insulation.

When pressed to prove such high R-values, they talk about the "mass factor." The impact of high thermal mass on the performance of buildings is real, but such high R-values are only apparent. Their methods of calculating insulating values are not directly comparable to other insulation products, and are achievable only in hot desert climates like the US Southwest. The principles by which such calculations are made are not transferable to a colder northern climate, which is dominated by heating concerns. ☼

Is This Why Home Prices Have Increased?

Statistics Canada tells us that in 1961, Canadian homes had an average of 5.3 rooms and a household of 3.9 people. (Kids were routinely doubled up). The 1986 census showed that the average dwelling unit has expanded to 5.8 rooms, while the size of household has shrunk to 2.8 people. The 2001 census shows the average household to be 2.5 people, while the average number of rooms has increased to 6.0. If the pattern continues, today's kids can expect to have smaller families (if they have any children of their own).

Part of the change of dwelling size has been accounted for by renovations and additions: between 1981 and 1986 the number of houses with seven or more rooms increased by 514,935!

If families are getting smaller and the population is aging, why do virtually all houses (and even many townhouse units) still have three bedrooms? In an earlier era (20 - 30 years ago and earlier) many small two bedroom houses were built and served the needs of large families. Perhaps now is the time to consider modifications to home designs we build today. ☼

Energy Answers

Rob Dumont

In the first blast of cold weather in the fall, the old windows on my house fog up along the bottom. However, as the winter progresses, I notice that there is less condensation on the windows, even though the outside temperature is roughly the same as during the first cold spell. We don't use a humidifier in our house. Why does this fogging happen in the fall?

The main reason why you experience window fogging in the fall is that the relative humidity (RH) in your house air is higher at that time than it is later in the winter. During the summer months, moisture in the outside air infiltrates the house and is absorbed by the building materials. This stored moisture is then gradually released into the house air from the building materials through the heating season.

The following chart shows how warm air (i.e., outdoor Canadian summer air) can hold much more water vapour than cold air (i.e., outdoor Canadian winter air). Note that at an outdoor air temperature of +30 °C the maximum moisture content of air is 27 grams of water per kilogram of air. At an outdoor air temperature of -30 °C, however, the maximum moisture content of air is less than ½ of a gram of water per kilogram of air. In the summer that moist air on the right side of the diagram is absorbed by the building materials. In the heating season, the dry air on the left side of the diagram enters the house and withdraws moisture from the building materials.

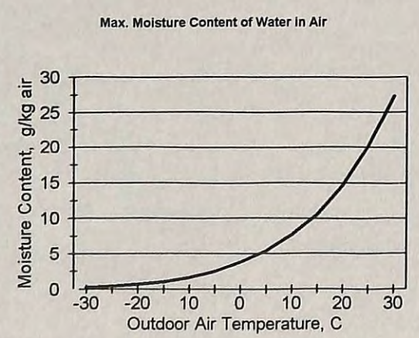


Figure 1. Relationship between maximum moisture content of water in air and outdoor temperature. ('It's a dry cold' is more than a saying.)

In Figure 2 some measured relative humidity data from a 1966 study of southern Canadian homes by Kent, Handegord and Robson of NRC is presented. There are two trends to note on the graph. First, the relative humidity in the houses drops as the outdoor air temperature drops. Second, the relative humidity values in the houses during the August to December period are mostly higher than those readings from the Jan. to July period, when the houses are drier.

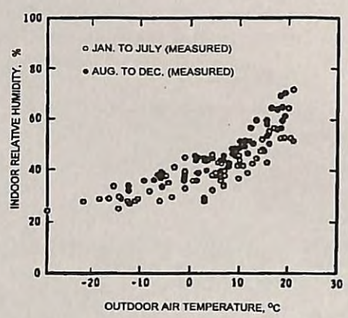


Figure 2. Measured Relative Humidity Values in Southern Canadian Homes (Kent, Handegord, and Robson, NRC, 1966)

How can I prevent my windows from fogging?

The basic problem is that the surface temperatures of the windows on the interior are below the dew point of the air in the house (the dew point is the temperature at which moisture in air will condense from a vapour to a liquid). There are two solutions. You can increase the surface temperature on the windows or lower the relative humidity of the air in your house so that it has a lower dew point temperature.

To increase the surface temperature on the windows, you can

1. Ensure better air flow from the room over the window by opening curtains, raising venetian and other blinds, etc. I have actually seen some people use fans to blow air against the window to try to solve the problem.
2. Caulk around the windows to prevent cold air from chilling the window.
3. Add an interior layer of glass or plastic to the windows. Make sure the new glass or plastic layer is well sealed to prevent moist air leaking past the new layer of glass or plastic.
4. Buy new windows with superior R values. In our house we have triple glazed windows with 2 low e coatings, argon gas, and a nonmetallic (insulating) spacer bar. Condensation on these windows is extremely rare, even though temperatures of minus 35 °C will hit Saskatoon, and we maintain an RH of about 30% through the winter months.

To reduce the relative humidity in your house in the heating season, the only practical ways are to reduce the interior moisture sources or to increase the ventilation rate. (Dehumidifiers don't work very well in winter, as they can only reduce the relative humidity to about 50%, and you probably want to lower the humidity to about 30% or less in colder weather.)

1. Reduce moisture sources inside the home by turning off humidifiers, removing plant material, keeping firewood stored outdoors, venting your clothing's dryer to the outside, covering any hot tubs, fixing basement wall and floor leaks, covering sumps, etc., etc.
2. Increase the ventilation rate using an exhaust fan, a heat recovery ventilator, or an outside air duct connected to the return air plenum on your furnace. Be very careful with exhaust-only ventilation systems, as they can readily backdraft chimneys in tighter houses.

I prefer the heat recovery ventilator, as the exchanger will recover heat from the air being exhausted. ☼

NRC·CNRC

Joint Consultation on Building, Fire and Plumbing Codes starts January 2003

By John Archer

Beginning in January 2003, code users across Canada will be able to review and comment on proposed technical changes to the building, fire and plumbing codes and "test drive" the proposed format and structure of the new objective-based codes.

Readers of **Solplan Review** will be aware that the current National Building, Fire and Plumbing Codes were published in 1995. These national codes have traditionally been updated and re-published every five years and new codes would normally have been expected in 2000. The technical updating of the codes for 2000 was postponed, however, because of the considerable development work necessary for the conversion to the objective-based format. But now, with the analysis of the objective-based codes complete and their structure and format well advanced, the development and review of the proposed technical changes – the actual content of the codes – is proceeding quickly.

The technical updating of the national codes has always followed a rigorous process that involves the submission of detailed proposals for code changes, review by the standing committees, consultation with the provinces and territories on policy issues, public review and comment and, finally, approval of those technical changes that survive the process. All of this takes place under the direction of the Canadian Commission on Building and Fire Codes.

The public review, which starts 2 January 2003 and runs to 31 March 2003, is the first coordinated national/provincial/territorial consultation on technical changes in Canada. With the exception of Alberta, which will consult on its province-specific changes later in 2003, technical changes to both the national codes and the provincial/territorial codes will be issued for public review at the same time. This new approach is more efficient because it allows code users to review and comment on all proposed technical changes to the codes concurrently. The comments will be shared by the national/provincial/territorial partners, and will encourage greater harmonization of the codes in the long term.

As well, code users will be able to "test drive" prototypes of the three objective-based national codes. The committees encourage users to provide feedback on the approach taken with the new codes, such as the structure, new terminology, and links from each requirement to its functional statements and objectives.

The main vehicle for the consultation is the Internet. Code users are encouraged to visit the web site of the Canadian Commission on Building and Fire Codes at www.nationalcodes.ca after 2 January 2003 where they will find links to:

- The consultation documents,
- The proposed technical changes to the national model codes,
- Provincial and territorial web sites for jurisdiction-specific technical changes,
- The prototype objective-based National Building Code, National Fire Code and National Plumbing Code,
- Dates and locations for public forums on the proposed technical changes and the prototype objective-based codes.

Code users will be able to comment directly "on line" from the web site or may download the comments form to be sent in later by email, fax or surface mail. A series of public forums is also planned in several provinces and territories. Staff of the Canadian Codes Centre at the National Research Council's Institute for Research in Construction will demonstrate the new objective-based codes and review the significant proposed technical changes to all three codes. Currently a one-day forum for the building code is planned, with a half day for the fire code. ☼

Readers may send questions on the consultation, or requests for printed copies of the consultation documents, to:

John Archer, Secretary,
Canadian Commission on Building and Fire Codes
Canadian Codes Centre, Building M23A
National Research Council
Ottawa, ON K1A 0R6
Telephone: (613) 993-9960
Facsimile: (613) 952-4040
Email: codes@nrc.gc.ca
www.nationalcodes.ca

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Coming Events

Ontario Building Forum
January 15-16, 2003
Toronto, ON
Tel: 416-443-1545 or 800-387-0109
Fax: 416-443-9982

January 30-31, 2003
Enerhouse 2003
Halifax, NS
Tel: 902-450-5558
Fax: 902-450-5448

February 23-25, 2003
CHBA Annual Conference
London, ON
Tel: 905-954-0730
Fax: 905-954-0732

February 27-28, 2003
9th Conference on Building Science & Technology
Vancouver, BC
tel: 604-294-0043
Fax: 604-299-4517
www.bcbec.com

March 5-7, 2003
World Sustainable Energy Day 2003 Conference and Trade Show
Wels, Austria
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www.esv.or.at

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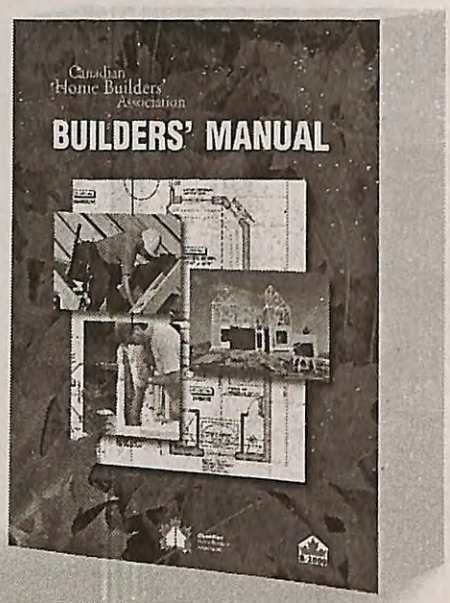

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